DFTM Survey

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DOUGLAS-FIR TUSSOCK MOTH EARLY INSTAR LARVAL POPULATION MONITORING ON OREGON AND WASHINGTON NATIONAL FORESTS - 1982

INTRODUCTION

Douglas-fir tussock moths can increase to damaging levels very rapidly in Douglas-fir and true fir forests. In 3 years, populations can increase from endemic numbers to outbreaks where top-killing and whole tree mortality occur (Wickman et al 1973). Early detection of an increasing population is necessary to invoke management actions before tree damage occurs. The timing and organization of various evaluation techniques is important to provide land managers with timely biological information (Gregg and Twardus 1981).

An evaluation survey using traps baited with a synthetic sex pheromone of the female moth has been in effect since 1980. The survey includes the Douglas-fir and true fir types east of the Cascade Mountains of Oregon and Washington. The number of moths caught is an indication of the number of larvae that will be present the following spring. The potential for damage caused by the Douglas-fir tussock moth is measured by the number of larvae present.

This report summarizes the status of first and second instar larval populations of the Douglas-fir tussock moth during the 1982 season.

METHODS

In 1981 there was no defoliation by the Douglas-fir tussock moth detected during the aerial sketchmap survey; however, the pheromone trap survey suggested increasing populations (USDA Forest Service et al 1981). The pheromone trap survey followed the procedures of Daterman et al 1979 on 404 plots covering all eastern Oregon and Washington National Forests, the Colville and Yakima Indian Reservations, and the Central Oregon Bureau of Land Management District. Larval populations in the vicinity of plots with high trap catches (>25 ave./trap) and other related populations in the vicinity of lower trap catches were evaluated during July 1982 using the procedures of Mason, 1979.

Population densities in all areas to be evaluated were first classified into general categories by sequential sampling in the lower crown. At those areas where populations were classified as low-level, no further sampling was done. Intermediate and suboutbreak populations were further sampled for an estimate of midcrown larval densities. Midcrown larval densities for intermediate populations were estimated by frequency of occurrence in lower crown. Midcrown larval densities for suboutbreak populations were estimated by sampling midcrown branches with a polepruner and a catchbasket.

RESULTS

Capture rates for pheromone-baited traps during 1981 and the subsequent larval densities on the same plot during 1982 are summarized in Table 1.

The following is a plot-by-plot description of all areas evaluated for early instar larval populations.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Rattlesnake - Okanogan NF
T. 36 N., R. 18 E., sec 2

Western spruce budworm samples in the Rattlesnake Campground vicinity have, for the last several years, commonly included larvae of the Douglas-fir tussock moth. Pheromone-baited traps have captured an increasing number of Douglas-fir tussock moths. In 1980, capture rate averaged 9.8 per trap. In 1981, the capture rate increased to 48.0 per trap. Sequential larval samples classified the population as low-level. Lower crown larval samples estimated the midcrown density at the campground to be 0.02 larvae per 1000 square inches of foliage. Another similar midcrown larval density estimate was made 0.2 miles east of the campground and found 2.77 larvae per 1000 inches of foliage.

Gold Creek - Okanogan NF
T. 31 N., R. 21 E., sec 3.

Pheromone-baited traps have for the last 2 years collected moderate numbers of moths. In 1980, the capture rate was 10.7 with a slight upward trend for 1981 with 18.7 male moths per trap. Three sequential larval samples in 1982 classified populations as low-level. Frequency of occurrence in the lower crown estimated the midcrown density at 1.54 per 1000 square inches of foliage.

Conconully - Okanogan NF
T. 35 N., R. 24 E., sec 16

In 1980, pheromone-baited trap catch was only 1.6; however, in 1981, a significant increase occurred when 49.8 moths per trap were captured. In 1982, sequential larval sampling at the trap site found 3 low-level, 1 intermediate, and 1 suboutbreak samples. Lower-crown samples taken about 1/2 mile north of this site estimated the midcrown density at 0.16 larvae per 1000 inches of foliage.

First Creek - Wenatchee NF
T. 27 N., R. 21 E., sec. 6

This area is on the south shore of Lake Chelan and is adjacent to the Lake Chelan State Park. Male captures in pheromone-baited traps have been high for the last 2 years. In 1980 and 1981, the average capture rate was 10.8 and 34.8 male moths, respectively. All 9 sequential larval samples in 1982 in the area classified the population as low. Midcrown larval population estimates from lower-crown samples were 1.72 larvae per 1000 inches of foliage.

Forest Mountain - Wenatchee NF
T. 27 N., R. 21 E., sec. 8

This area is about 1½ miles from the First Creek plot. Until this year, it generally had a lower tussock moth population than the First Creek plot. Average trap catches for 1980 and 1981 were 4.2 and 46.6 moths, respectively. Five sequential samples were taken with 4 classifying the population as low-level and 1 as intermediate. Midcrown larval density estimated from lower crown frequency of occurrence in 1982 showed 1.15 early instar larvae per 1000 inches of foliage.

Icicle Creek - Wenatchee NF
T. 24 N., R. 16 E., sec. 17

The sample area is located in the vicinity of Johnny Creek Campground on Icicle Creek. Male capture rate at this plot was low in 1980 with an average of 0.4 moth per trap; however, in 1981 capture rate was 45.6 per trap. All 7 sequential samples taken classified the population as low-level. Lower-crown larval sampling in 1982 showed a relatively low population with a midcrown estimate of 1.43 larvae per 1000 square inches of foliage.

Lake Wenatchee Plain - Wenatchee NF
T. 26 N., R. 17 E., sec. 2

This plot is located about 3 miles southeast of Lake Wenatchee. In 1980, no male moths were captured in pheromone-baited traps, but in 1981 an average of 45.6 males were captured per trap. Early instar larval surveys in 1982 also reflected higher population levels. Sequential samples classified 3 low, 1 intermediate, and 1 suboutbreak. Midcrown densities averaged 2.62 larvae per 1000 square inches of foliage.

Colville Indian Reservation - ON-8
T. 32 N., R. 30 E., sec. 27
and
Colville Indian Reservation - SP-1
T. 29 N., R. 32 E., sec. 16

Only 1 year of pheromone-baited trap data is available for these two plots. The first sampling of these plots with traps was in 1981. Plot ON-8 captured an average of 25.4 male moths per trap, while SP-1 captured an average of 27.2. Sequential sampling of early instar larvae in 1982 resulted in all samples classifying the population as low-level. Population density sampling was not done.

Bear Valley #7 - Malheur NF
T. 16 S., R. 28 E., sec. 30
and
Bear Valley #3 - Malheur NF
T. 15 S., R. 31 E., sec. 36

Both of these trap plots are located southwest of John Day. Trapping was not done in 1980, but in 1981 an average of 27.4 moths per trap were collected on Plot #7 and 36.4 moths per trap on Plot #3. Sequential samples on Plot #7 classified 7 as low and 1 as intermediate. Eleven sequential samples were taken on Plot #3 with all classifying the population as low. Midcrown population density estimates were not made.

Aldrich Mountains - Malheur NF
T. 14 S., R. 28-29 E.

Mid Fork John Day River - Malheur NF
T. 11-12 S., 32-34 E.
and
Logan Valley - Malheur NF
T. 15-16 S., 33-36 E.

Pheromone-baited trap plots were located throughout each of the above areas in 1981. All trap plots collected low numbers of male moths. Larval sampling in

1982 also reflected a low tussock moth population level. Twenty sequential samples were taken with all populations classified as low. Sequential samples were taken at 2- to 5-mile intervals along selected roads throughout the areas. Population estimates of early instar larvae were not made.

Burns #7 - Malheur NF
T. 19 S., R. 29 E., sec. 33
and
Burns #1 - Malheur NF
T. 21 S., R. 32½ E., sec. 4

Pheromone-baited traps on the Burns #7 plot collected an average of 28.4 male moths during 1981. Capture rate was lower on the Burns #1 plot with an average of 19.4 males. All 15 sequential samples were classified as low-level; no population density estimates were made.

Unity #3 - Wallowa-Whitman NF
T. 14 S., R. 36 E., sec. 1

This plot is located at the Record Mine site. The 1981 pheromone trap capture rate averaged 43.4 males per trap, a substantial increase over 1980 when an average of 0.25 per trap was captured. Sequential larval surveys in July 1982 failed to find any larvae.

Pine #8 - Wallowa-Whitman NF
T. 7 S., R. 44 E., sec. 3

In 1980, this plot captured no male moths in the pheromone-baited traps. However in 1981, there was an average of 44.0 males in each trap. No larvae were found in subsequent surveys in 1982. Samples were taken at the trap site and in other timber stands adjacent to the site.

Pine-Road Jct. 66 & 6660 - Wallowa-Whitman NF
T. 6 S., R. 46 E., sec. 28

This area has not been surveyed with pheromone-baited traps. Tussock moth egg masses and cocoons were discovered and recorded in 1980 while surveying for western spruce budworm egg masses. Larval surveys were not made, but egg masses and cocoons were again noted in 1981. A reliable estimate of egg mass density could not be made at that time due to snow covering the foliage. In July 1982, fifteen sequential larval samples were taken at plot locations and in adjacent stands. At plot location, 1 sample was classified as suboutbreak, 1 as intermediate, and all other samples, including those from adjacent stands, classified the population as low-level. Estimated midcrown larval density was 2.23 per 1000 square inches of foliage. At this plot, midcrown densities were estimated by sampling 3 midcrown branches on each of 15 trees with a polepruner and catchbasket.

Bly #2 - Fremont NF
T. 38 S., R. 13 E., sec. 32

Pheromone-baited traps captured an average of 35.4 male moths in 1981. The plot was not sampled with traps in 1980. Early instar larval surveys in 1982 did not find any larvae.

Klamath #3 - Winema NF
T. 36 S., R. 6 E., sec. 26
and
Klamath #5 - Winema NF
T. 34 S., R. 6 E., sec. 2

These two plots are within the Mares Egg Spring area north and west of Klamath Lake. This area is known to maintain higher endemic tussock moth populations than elsewhere. Populations here have been monitored by research entomologists from the Pacific Northwest Forest and and Range Experiment Station. Midcrown larval samples were taken at 8 plots in 1982. Average density for all 8 plots was 0.60 larva per 1000 square inches of foliage.

DISCUSSION

Early instar larval surveys of the Douglas-fir tussock moth are only part of a much larger monitoring plan to determine population levels and to provide early warning of an imminent outbreak. Managers can be alerted when population densities have reached levels where, with further population increases, serious defoliation can occur within 2 years. The survey results show that serious defoliation is not likely to occur before 1984.

The number of larvae become most significant when considered in relationship to the threat of defoliation on the host trees. Mason (1978), using a density of 20 early instar larvae per 1,000 square inches of foliage as a threshold for causing visible defoliation, and an annual average multiplication rate of 7 has reasoned that a density of one larva per 1,000 square inches of foliage will require more than 2 years before visible defoliation can occur. Using the same reasoning, he determined that populations of three or more larvae per 1,000 inches of foliage can multiply into a defoliating density the following year.

No areas were found that are in imminent danger of defoliation. However, some areas surveyed show more potential than others for eventual defoliation. Based on the density of early larvae, the following areas show the greatest potential for defoliation in the near future:

1. Rattlesnake Campground, Okanogan National Forest, with a larval density of 2.77 per 1,000 square inches of foliage.

2. Conconolly, Okanogan National Forest, is a plot that is hard to understand. At plot center, adult and larval densities are high; yet, at 1/2 mile away, larval density is 0.16 per 1,000 square inches of foliage.

3. Lake Wenatchee-Plain, Wenatchee National Forest, with a larval density of 2.62 per 1,000 square inches of foliage.

4. Pine-Road Jct. 66 and 6600, Wallowa-Whitman National Forest, with a density of 2.23 per 1,000 square inches of foliage.

At several survey areas, clumping or discontinuous populations of larvae were noted during the surveys. This clumping was particularly noticeable at those areas of higher larval densities. The Rattlesnake plot at one point had a larval density of 2.77 per 1,000 square inches of foliage; yet, 0.2 miles away, the density was down to 0.02 larvae for the same amount of foliage. A similar

example occurred at the Conconully plot where sequential samples at trap location classified the population as suboutbreak to intermediate. One-half mile away, midcrown density was only 0.16 per 1,000 square inches of foliage. On the Wallowa-Whitman National Forest, the plot at Road Junction 66 and 6600 also showed a similar discontinuous population pattern. Knowledge of this clumping tendency should be helpful when doing future larval surveys. Limiting the distribution of sample points, particularly with the sequential samples, increases the risk of misleading or incorrect conclusions.

In 1983, the early instar larval survey will again be made at those locations where tussock moth populations are suspected to be on the increase. The pheromone-baited trap survey, made the previous fall, will be used as a primary indicator of a population change.

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Table 1--Summary of Pheromone-baited Trap Captures and of Subsequent Larval Densities for Selected Plots in Oregon and Washington

Plot or Area	Location T.	Location R.	Location sec.	Mean No. Males Per Trap 1980	Mean No. Males Per Trap 1981	Number of Sequential Samples and Classification 1982	Population Estimates Larvae per 1000 in.^{2} Foliage 1982
WASHINGTON:							
Okanogan NF - Rattlesnake 1/	36N	18E	2	9.8	48.0	5 Low Level	0.25
Okanogan NF - Rattlesnake 2/	36N	18E	2	No sample		No sample	2.77
Okanogan NF - Gold Creek	31N	21E	3	10.7	18.75	3 Low Level	1.54 3/
Okanogan NF - Conconully	35N	24E	16	1.6	49.8	3 Low Level 1 Intermediate 1 Suboutbreak	0.16 4/
Wenatchee NF - First Creek	27N	21E	6	10.2	34.8	9 Low Level	1.72
Wenatchee NF - Forest Mountain	27N	21E	8	4.2	46.6	4 Low Level 1 Intermediate	1.15
Wenatchee NF - Icicle	24N	16E	17	0.4	45.6	7 Low Level	No sample
Wenatchee NF - Lake Wenatchee	26N	17E	2	0.0	26.0	7 Low Level 1 Intermediate 1 Suboutbreak	2.62
Colville I.R. - ON-8	32N	30E	27	No sample	25.4	7 Low Level	No sample
Colville I.R. - SP-1	29N	32E	16	No sample	27.2	5 Low Level	No sample
OREGON:							
Malheur NF - Bear Valley #7	16S	28E	30	No sample	27.4	7 Low Level 1 Intermediate	No sample
Malheur NF - Bear Valley #3	15S	31E	36	No sample	36.4	11 Low Level	No sample
Malheur NF - Aldrich Mtns.	14-15S	28-29E 5/		No sample	No sample	7 Low Level	No sample
Malheur NF - Mid.Fk. John Day	11-12S	32-33-34E 5/		No sample	No sample	8 Low Level	No sample
Malheur NF - Logan Valley	15-16S	33-36E		No sample	6/	5 Low Level	No sample
Malheur NF - Burns #7	19S	29E	33	No sample	28.4	7 Low Level	No sample
Malheur NF - Burns #1	21S	32½E	4	No sample	19.4	8 Low Level	No sample
Wallowa-Whitman NF - Pine #8	7S	44E	3	0.0	44.0	10 Low Level	No sample
Wallowa-Whitman NF - Pine	6S	46E	28	No sample	No sample	13 Low Level 1 Intermediate 1 Suboutbreak	2.23
Wallowa-Whitman NF - Unity #3	14S	36E	1	0.2	43.4	2 Low Level	No sample
NRA (South Portion)	5-6S	47-48E		7/	7/	11 Low Level 1 Intermediate	8/
Fremont NF - Bly #1	38S	13E	32	No sample	35.4	? Low Level	No sample
Winema NF - Klamath #3	36S	6E	26	No sample	52.4	No samples	9/
Winema NF - Klamath #5	34S	6E	2	No sample	51.2	No samples	9/

1/ At the Rattlesnake Campground.

2/ At 0.2 miles east of Rattlesnake Campground.

3/ Two 60-tree samples were taken approximately one mile apart. Population density estimates are a combination of the two samples.

4/ Population estimate was made about 1/2 mile away from sequential sample site.

5/ Samples taken in the Aldrich Mountains and the Middle Ford of the John Day River were not taken at a pheromone-trap plot. Sequential samples were taken throughout the area.

6/ Several pheromone-baited trap plots were located in the Logan Valley in 1981. Capture rate ranged from 0.4 to 20.0 male moths per trap. Early instar larval survey plots were also located at various locations in 1981.

7/ Several pheromone-baited trap plots were located in the southern portions of the NRA in 1980 and 1981. Capture rate ranged from 0.0 to 3.4 in 1980 and from 0.0 to 77.2 in 1981. Early instar larval survey plots were also located at various locations in 1981.

8/ At one early instar larval survey plot (T. 6 S., R. 47 E., sec. 9), midcrown density was estimated to be 1.31 larvae per 1000 square inches of foliage. Density estimate made by proportioned infested tree method (Mason, 1979).

9/ Larval sampling done by PNW Exp. Sta. Average larval density for area was .602 per 1000 square inches of foliage.

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